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INFECTIOUS ABORTION OF SWINE

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Although the subject of infectious abortion of cattle has been exhaustively studied for the past 35 years, it is apparent that little intensive research has been directed toward the same disease of swine. Records in our laboratory indicate either that the importance of the loss due to abortion of swine is becoming more appreciated, or that there is an alarming increase in its prevalence. A search of the literature reveals one paper on the subject. Good and Smith[1] studied three field outbreaks and report the causative agent to be B. abortus (Bang), which they succeeded in isolating from an aborted fetus.

For the past five years a portion of the routine work of this laboratory has consisted of making agglutination tests of blood from cattle suspected of infection with abortion disease. Occasionally, blood samples from swine have been received for the same test, and these were tested with the same cattle strain antigen. The results of these tests are recorded here, with a brief history of the herd when available.

1. Blood from a sow: According to the history of the herd, 9 of 15 sows aborted in the summer of 1917, and 6 of 10 in the summer of 1918. The agglutination test of the one sow was negative.

2. Thirty-nine blood samples from a herd of 200 brood sows: Seventy abortions had occurred within 6 weeks. The results of this test were startling; twenty-eight (66%) showed agglutination in a serum dilution of 1:100; eight (21%), including one boar, showed no trace of agglutination, and the other five agglutinated only in dilutions lower than 1:100.

3. Six samples from a herd with a general history of abortion: Two gave complete agglutination with a dilution of 1:500; the other 4 were negative.

4. Three samples from a small herd: Four sows, which had been bred to an old boar, had aborted. Nine young sows, which were raised on the same farm, were bred to a young boar and 8 aborted. The 4 old sows were bred to the young boar, and again all 4 aborted. Six sows were bought after having been bred; they were brought to this farm and placed in the same pens; 1 aborted. Of the 3 blood samples, 1 was negative; another agglutinated in a dilution of 1:500, and the blood from the old boar was negative.

5. One sample from a sow which had recently aborted; another from a boar: Both samples agglutinated completely in a dilution of 1:500.

6. Eighteen samples from a herd of 28: Four abortions had just occurred in this herd. Of these samples, 9 agglutinated in a dilution of 1:100 or higher·

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[1] Jour. Bacteriol., 1916, 1. p. 415.

9 were negative. Of the 9 positive reactions, 2 had aborted, 1 was said never to have been bred, and 2 had been bred and were presumably pregnant at the time of bleeding. The record on the remainder of the herd was incomplete.

2b. Samples from 7 brood sows from the same source as herd 2a. Four of these samples agglutinated in a dilution of 1: 100; 3 were entirely negative.

7. Fourteen samples were tested from a herd; no data were available. Twelve agglutinated in a dilution of 1: 100 or higher; only 2 were negative.

2c. Blood from 6 gilts suspected of infection from the same source as herds 2a and 2b: Two samples agglutinated at 1: 200; 2 agglutinated at less than 1: 100; and 2 were entirely negative.

8. Five samples were tested from a small herd with a general history of abortion. Three agglutinated at 1.200; one was positive only at 1: 50; the other one only at 1: 20.

9. Recently a sample from a valuable brood sow was tested. This sow showed a vaginal discharge, and had been bred without conceiving. Agglutination was complete at a dilution of 1: 500.

10. Twelve cholera hyperimmune hogs, both male and female, which may be regarded normal as to history of abortion, were tested. Five showed only a doubtful trace of agglutination in dilution of 1: 20; one showed a doubtful trace at 1: 50; all others were negative.

These brief histories cover a report of tests of 114 hogs of both sexes, and of varying ages, with these results:

Results of Tests

		Positive at 1: 100 Dilution	Negative at 1: 100 Dilution
Sows	92	57	35
Boars	3	1	2
Gilts	7	3	4
Normal hogs	12	0	12
	114	61 (53%)	53 (46%)

From these data it appears that 50% of swine of mixed origin, or 62% of animals from herds with a history of infectious abortion, gave positive agglutination in a dilution of the serum regarded as diagnostic of this disease of cattle. Furthermore, the antigen used was in all cases a mixed suspension of two or three strains of B. abortus (Bang) of cattle origin. The significance of these results is apparent, and at the earliest opportunity attempts were made to isolate this organism from swine.

In July, 1919, a portion of afterbirth from a sow of herd 2a was received. The tissue was triturated in normal salt solution, and 1.5 c.c. of the washing was injected intraperitoneally into each of two guinea-pigs. At the same time these animals were bled and the serum tested with B. abortus (Bang) cattle strain antigen; no agglutination appeared in any dilution. Four weeks after inoculation the pigs were bled and the blood of both pigs agglutinated the antigen completely at 1 :500.

Five weeks after inoculation the guinea-pigs showed considerable emaciation and were killed. There were numerous whitish nodules in the liver; much enlarged spleen; some nodules in the lungs, and a large quantity of serous fluid in the pleural cavity. Serum-agar slants and shakes were seeded from the liver and spleen. No growth was perceptible after 48 hours, but on the third day all shakes and slants showed a moderate surface growth of an apparently pure culture. Suspensions of this growth were tested with a known positive cow serum, and were completely agglutinated in all dilutions up to 1 : 500.

Rabbits were injected intravenously with suspensions of killed organisms of four strains of B. abortus (Bang) of cattle origin, and of this strain of swine origin. Potent antiserum was developed against the respective homologous antigens. Cross-agglutination tests between all cattle strains and the swine strain showed the same degree of agglutination as with homologous antigens. No distinction could be made between the cattle and swine strains.

Antiserum against the swine strain was absorbed by antigen of each of the four cattle strains, and antiserum against each of the four cattle strains was absorbed by antigen of the swine strain. Agglutinins were absorbed completely in all cases, as indicated by test of the absorbed serum with the respective homologous antigen.

Gram stains from an agar slant culture of the swine strain showed the organism to be gram-negative, and to conform to the well-known morphology of typical B. abortus (Bang). No motility was perceptible, and flagella could not be demonstrated.

Comparative cultural tests were made simultaneously with the four cattle strains and the one swine strain. All five strains conformed to the published characteristics of B. abortus (Bang), except for a few slight variations. Several additional characteristics are worthy of note:

When inoculated into slightly alkaline 2% glucose agar shakes the 4 cattle strains first showed the usual subsurface growth to a depth of about 3 mm. At the lower limit of this growth a pronounced zone of growth produced a distinct "diaphragm." By the third day the surface growth was fairly prolific. In the same medium the swine strain showed a few surface colonies at 24 hours, and a trace of subsurface growth, but no evidence of the diaphragm.

In 2% glucose agar shake cultures titrated to slight pink to the Andrade indicator, and to which 1% of this indicator was added, the color was reduced at 24 hours to the depth of growth, below which the color remained sharply defined for 3 days. This decolorization progressed slowly so that at 7 days the color had entirely disappeared. All strains behaved alike in this respect.

A perceptible surface blackening was developed by all strains on lead acetate agar at 24 and 48 hours. This darkening did not approach the degree produced by B. paratyphosus B on the same medium, but had more the appearance of a grayish pigment; no such color appeared on plain agar.

Serum-water was prepared with the addition of 1% of the Andrade indicator and 1 per cent. of the following sugars and fermentable substances: dextrose, lactose, saccharose, mannite, arabinose, xylose, dulcite, inosite, maltose, levulose, galactose salicin and dextrin. Moderate acid was produced by all four cattle strains in arabinose; a doubtful trace of acid was produced in the same medium by the swine strain and sharp differentiation was produced on repetition. Three cattle strains produced a trace of acid in levulose; no acid was perceptible in the same medium inoculated with the fourth cattle strain nor with the swine strain.

Except for the reaction in arabinose serum-water, none of the slight cultural variations were sufficiently distinctive to counteract the evidence of close relationship, if not the identity of the five strains, as indicated by direct and cross-agglutination, and by absorption tests.

Artificial infection of guinea-pigs in effecting the isolation of the swine strain, together with development of lesions and agglutinins, and cross-agglutination with cow serum and cattle strain antigen, appears to establish the identity of this swine strain with typical B. abortus (Bang).

SUMMARY

The history of eight herds indicates that infectious abortion of swine is a serious and increasingly important source of loss to the swine industry.

Inoculation of two guinea-pigs with triturated afterbirth from an aborting sow resulted in an infection, as demonstrated by the development of agglutinins and typical lesions. At the time of inoculation the blood of the two guinea-pigs did not agglutinate a B. abortus (Bang) antigen. Four weeks after inoculation the blood agglutinated this antigen completely in all dilutions up to and including 1 : 500.

An organism was isolated from the liver and spleen of both guinea-pigs, which, except for slight cultural peculiarities, is indistinguishable morphologically, culturally, or agglutinatively from typical B. abortus (Bang).

Rabbit antiserum for four cattle strains and for this swine strain gave cross-agglutination to the same titer as with the homologous antigens.

Antigen of the swine strain completely absorbed agglutinins from antiserum for each of the four cattle strains.

Antigen of the four cattle strains each completely absorbed agglutinins from antiserum for the swine strain.